in particular. The examination of its trade relations, however, may entail a visit to the neighbouring Trobriands. If it prove possible, he will also proceed so far afield as Rossell Island, where certain ethnological problems of peculiar interest await solution.

SOME AMERICAN ORE DEPOSITS.[1]

NEW MEXICO has one of the longest mining histories of the western United States, for its semi-civilised aborigines, the Pueblo Indians, mined gold and turquoise before the arrival of the first white explorer in 1534. The Jesuit missions converted the Indians to Christianity, and then sweated them as miners until they were goaded into revolt, and the Spaniards were only readmitted on condition that their industrial operations were confined to agriculture. Mining was only resumed with the discovery of the copper-bearing sandstones at the close of the eighteenth century. Placer mining was started in 1828; the modern era of active mining was begun about 1866 upon the silver-lead ores, followed during the present century by the opening of mines of copper, lead, and zinc. The State contains large deposits of bituminous coal of Cretaceous age.

The geology of the country has a long and scattered literature. A general survey of its metalliferous mining fields was made in 1905 by Dr. W. Lindgren, Louis C. Graton, and C. H. Gordon, and a preliminary account of their results was issued as a Bulletin (No. 285) by the United States Geological Survey in 1906. The volume containing the detailed account of their researches consists of a general summary of the economic geology, followed by descriptions of the separate fields and mines. The work will no doubt remain for years the standard authority on the mines of New Mexico, and will repay study by all students of ore deposits. It contains, moreover, instructive evidence on some problems of general geology. The volume is illustrated by instructive topographic maps, mine plans, and plates; a geological map of the State, however incomplete, would have been very useful.

New Mexico has a base of Archæan crystalline rocks covered unconformably by Cambrian quartzites. The northern part of the State shows the stratigraphical gap so characteristic of the Rocky Mountain sequence, for the Cambrians are followed by the Carboniferous; but the intermediate Palæozoic systems are represented in the Southern districts. The Mesozoic series, usually complete in the Rocky Mountains, is imperfect, as the Jurassic is sparsely represented. The Carboniferous beds include marine limestones, followed by "Red Beds," some of which belong to the Trias. The Cretaceous system includes 6000 feet of marine beds; their deposition was followed by active earth movements, and the intrusion of sheets and laccolites of granodiorites which lifted the overlying Cretaceous rocks into domes. Igneous activity was renewed in the middle Cainozoic, when wide lava flows were erupted from numerous volcanic vents; at the close of the Cainozoic came a third period of igneous activity, and the outpouring of vast sheets of basalt. The last eruptions were of very recent date.

The "metal deposits," as the Monograph calls them, for the term metallisation is replacing mineralisation, though both assume similar limitations—are divided by the authors into six groups. The oldest series, the ores in the pre-Cambrian rocks, contain gold and copper, and were developed as fahlbands in shear-zones.

The second group of ores are contact-formations around the laccolites. The evidence offered by the mines as to the range of the contact metamorphism is of much interest. The shales are altered for a very narrow width, but the limestones may be completely changed for half a mile. The authors are emphatic that the metasomatic are more important than the paramorphic changes, and that the addition of silica, iron, and sulphides from without is "positively proved." The fresh materials are attributed to emanations from the intrusive magmas. The limitation of contact metamorphism "simply to a rearrangement of molecules in a single bed is absolutely contrary to the facts." That these ores were not introduced in solution after the intrusive rock had cooled is shown by the unaltered condition of its border.

The igneous rocks belong to that granodiorite- and quartz-monzonite series which is so often associated with ore deposits. The rocks are granular, although they solidified at the comparatively shallow depth of sometimes only 2000 feet. The toughness of their cover appears to have prevented their reaching the surface.

The third series of ores are veins connected with the granodiorite intrusions. They are usually pyritic gold-quartz fissure-veins. The veinstones include albite, tourmaline, and fluorite, and the ores often include much blende. They are usually normal fissure veins, one of which is illustrated by a fine coloured plate of part of the vein. Such figures are very useful. The regular trend of the veins is doubtless due to compression during the intrusion of the igneous rocks.

Ore bodies and veins due to the replacement of limestone form a fourth group. They are associated with the igneous rocks, but occur some distance from the contact. The chief ores are of silver, lead, and zinc; the two chief minerals are galena and calcite. The most famous of these deposits is the ore-body known as the Bridal-Chamber, a mass of almost pure kerargyrite found in limestone beneath a cap of andesite. The authors regard the ore as older than the andesite, and as formed above a hidden intrusion of porphyry.

The fifth group of ores are veins connected with the Cainozoic volcanic rocks. They occur in shoots where the lavas have been propylitised, and have no doubt been formed by the action of hot mineral waters at a slight depth below the surface.

In connection with these veins the authors describe an interesting fluorite vein formed in gneiss by the hot springs at Ojo Caliente. The vein contains barite, limonite, oxide of manganese, silver, and gold. The richest examples assayed contained $75 of silver and $30 of gold to the ton. The mineral waters, owing to their predominant sodium carbonate and chloride, are described as of well-defined volcanic affinities (p. 71), and they supply an interesting addition to the known mineral veins formed by existing hot springs.

The last group of minerals are copper ores, usually chalcocite, in the Red Sandstones. The ores are epigenetic, but their distribution shows no relation to that of any igneous rocks; they contain no gold and very little silver. A coloured plate of these ores includes one in which the chalcocite has replaced coal. In the San Miguel Mine tree trunks 60 feet by 2½ feet in diameter have been almost completely replaced by glance. The widespread occurrence of copper in Red Sandstones of late Palæozoic and Triassic age has given rise to considerable discussion, and is a very suggestive fact. Dr. Lindgren discusses the origin of these ores, and rejects the theories of their precipitation from solution or formation by adsorption; and he concludes that they are due to minute traces of copper, some of which may have been sedimentary, by meteoric waters containing chlorides and sulphate. Mr. Graton offers a somewhat different explanation owing to the lack of evidence of descending acid solutions. He regards the chalcocite as introduced by ascending alkaline carbonates containing metallic sulphides in solution. As in the historic case of Mansfeld, the ores in the Sandstones appears to be most abundant above the richest copper-bearing veins in the underlying rocks, a fact which is in favour of Mr. Graton's view.

Mr. E. C. Harden's bulletin on the manganese deposits gives a summary of the known manganese deposits in the United States, and brings up to date Penrose's well-known monograph. The author's personal observations were made during a tour from January to April, 1908. The information then collected is supplemented from the literature and by chapters on the manganese deposits of other countries and on the chemistry and uses of the metal. The manganese ores of the United States belong to four main series. The first includes residual peroxides left by the

[1] "The Ore Deposits of New Mexico." By W. Lindgen, C. C. Craton, and C. H. Gordon. Pp. 361.
"Manganese Ore Deposits of the United States," with sections on Foreign Deposits, Chemistry, and Uses. By E. C. Harden. Pp. 298.
"Some Ore Deposits in Maie and Milan Mine, New Hampshire." By W. H. Emmons. Pp. 62. (Washington: Government Printing Office, 1910) (U. S. Geological Survey-Bulletins 432, 427, and Professional Papers 68).

decomposition of manganiferous silicates in crystalline rocks. The second type includes bedded ores; their manganese was derived from the silicates of crystalline rocks, and was deposited in the sedimentary rocks and then concentrated; this group includes the Appalachian ores, the most important in the United States. The two last groups comprise the manganese minerals associated with the silver ores of Leadville and other western mining fields, and the deposits with the Jurassic radiolarian jasperoids of California, which, according to Prof. Lawson, were deposited by suboceanic springs.

The chapter on the protean chemistry and uses of manganese describes the introduction of manganese steel in consequence of Hadfield's discovery that though the addition of 5 per cent. of manganese renders steel brittle and useless, the presence of about 12 per cent. produces a metal so hard, tough, and nonmagnetic that it has very important industrial applications.

Maine and New Hampshire are States in which mining is of secondary importance, but Mr. W. H. Emmons' short and interesting bulletin shows that ore deposits occur which have some features in common with those in the adjacent provinces of Canada. The geology is well known from Hitchcock's memoir and the later researches of Dr. G. O. Smith. The valuable minerals include gem-bearing pegmatites, which are not described in this bulletin, and some pyritic veins and ores of lead, zinc, silver, copper, and molybdenum. The basement of the area consists of metamorphic rocks, which are regarded as probably Archean; they are succeeded by sediments and volcanic rocks attributed to the Cambrian; the volcanic rocks were followed or accompanied by some igneous intrusions, beside which ores were formed as contact deposits. These rocks were then crushed to schists, at a date which is pre-Silurian, "but how much older is not known." Granitic intrusions followed in the Devonian.

The most interesting ores are the pyritic bodies, which here, as in other cases, give clear evidence of the depth at which the rocks were foliated, for the change took place where the ores were in the zone of fracture and the slates were in the zone of flow.

The bulletin contains some excellent illustrations of the microstructure of the ores. One of the most novel is of molybdenite ore from the Catherine Hill Mine. It is given to illustrate the author's view that the molybdenite was a primary constituent of the granite, and that the felspars floated in the liquid molybdenite; whereas the photograph, showing that the sulphide is permeating the large crystal of orthoclase and that a thin felspathic tongue with a disconnected end projects into the solid ore, rather indicates the secondary nature of the molybdenite.

J. W. G.

RECENT CONTRIBUTIONS TO THE STUDY OF HEREDITY.[1]

(1) PROTOZOA have as yet played but little part in the literature of heredity, and there are even some writers who belittle and disparage the evidence afforded by this group of animals on the ground that there is in them no separation of germ-plasm from somato-plasm. On the other hand, Jennings and Bateson have pointed out the importance of following the behaviour of conjugating and dividing Protozoa, since at such phases of life the phenomena of heredity are seen in a simple form. It is now known that this simplicity is deceptive. The protozoon does not simply cleave into two daughter cells, but first of all absorbs certain organs of its body, and after dividing its substance between the two or more descendants, leaves to them the further task of reforming these lost organs and other parts afresh. Moreover, in such a way is the cleavage carried out that the regenerating parts required by each daughter cell are not optically symmetrical. One may form a "head," the other a "tail," from what was the middle of the parental body. In other words, a dividing protozoon exhibits heredity under the form of alternate symmetry.

In the first paper on our list, this form of heredity is dealt with as fission. The particular animal studied is a species of Euplotes, a genus of ciliate infusoria commonly found on Hydra. Before division takes place, a new mouth is formed, independently of the existing one, by a depression of the ectoplasm, and a modification of its substance develops into a definite peristome. Meanwhile, the meganucleus elongates and becomes segmented into definite regions. The old cirri are gradually absorbed, and are replaced in the daughter cells by new structures. The author describes these changes in great detail, and promises another contribution upon the changes in Euplotes during conjugation.

(2) The pomace-fly, Drosophila, has been the subject of much recent investigation in America owing to its short life-history and the ease with which it breeds in captivity. The present paper, by Mr. F. E. Lutz, deals with the inheritance of abnormal venation in the wings of this fly. The facts, put very briefly, are that in wild specimens a few additional veins are occasionally, but rarely, met with, and the experimental evidence shows that in a large number of matings the percentages of such abnormally veined specimens are:—normal × normal, 9·6 per cent.; abnormal ♂ × normal ♀, 35·8 per cent.; normal ♂ × abnormal ♀, 54·7 per cent.; abnormal ♂ × abnormal ♀, 85·9 per cent. Discussing these remarkable increases in the ratio of abnormal to normal offspring, the author suggests that in *all* Drosophila gametes there is a factor tending to produce additional veins, but that its effects are often obscured, and only become visible in what may be called the upper part of its range. Especially interesting is the rise in the intensity of this factor when an abnormal strain is selected for breeding, and its rise and subsequent fall in a normal strain. Another point of importance is the observation that normally veined flies select normal mates when given a choice of both kinds. Mr. Lutz also gives a most interesting appendix on the question of disuse and degeneration of wings in this fly. Drosophila is a good flier, but when bred for forty generations under conditions that preclude the use of the wings, no degeneration or diminution in these organs can be detected. Altogether this is a very laborious and careful piece of research with bearings on many problems.

(3) The next two papers deal chiefly with the ovarian tissues of mammals. Much importance has been attributed to Guthrie's experiments on the transplantation of hen's eggs to foster-mothers of a different colour from that which produced the egg. According to this writer, the offspring of such foster-birds developed from the transplanted egg and were influenced by the foster herself. Davenport has recently denied both of these results, and now we have a contribution by Prof. Castle and Mr. Phillips upon similar experiments in guinea-pigs and rabbits. The results arrived at are not a little confusing. In the clearest case the procedure was as follows. The two ovaries of an albino were removed at intervals of a week, their places being taken by an ovary from each of two black sows of differing ancestry. After recovery, the albino foster-mother was put to an albino guinea-pig. Two hundred days later two ♀♀ were born, both of which were black with red hairs, and two months later one ♂ of the same colouring. Some three months afterwards the albino died of pneumonia, and was found pregnant with three full-grown ♂♂, again black and with red hairs interspersed. One of her daughters mated with the same albino ♂ threw two albinos and one black. A control mating between a pure black ♀ and the same albino ♂ gave five young, all of which were black with red hairs.

These results are held to show that the engrafted ovarian tissue was the source of the black young produced by this cross albino × albino, and that no foster-mother influence could be detected. But, on the other hand, all the remaining cases go to show that, as in Davenport's fowls, extirpation of the ovary is not complete, and is followed by regeneration, the regenerated ovary being the source from which the young produced

[1] (1) "Euplotes Worcesteri II. Division." By L. E. Griffin. *Philippine Journal of Science*, Vol. v. No. 6, December. 1910. Pp. 322–336+5 plates.
(2) "Experiments with Drosophila Ampelophila concerning Evolution." By F. E. Lutz. Pp. iii+40. (Carnegie Institution, Washington: Publication No. 143. March, 1911.)
(3) "On Germinal Transplantation in Vertebrates." By Prof. W. E. Castle and J. C. Phillips. Pp. 26. (*Ibid.*: Publication No. 144, March, 1911.)
(4) "The Maturation of the Egg of the Mouse." By J. A. Long and E. L. Mark. Pp. iv+72+6 plates. (*Ibid.*: Publication No. 142, April, 1911.)